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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/654,501	09/01/2000	Yuji Takahashi	PM 273792	7004

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EXAMINER	
BAUMEISTER, BRADLEY W	
ART UNIT	**PAPER NUMBER**
2815	

DATE MAILED: 12/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
09/654,501	Takahashi et al.
Examiner	**Art Unit**
B. William Baumeister	2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Oct 3, 2003*.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-3, 5-13, 15-22, 25-34, 38-46, 49, and 50* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-3, 5-13, 15-22, 25-34, 38-46, 49, and 50* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION[1]

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 43-45 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

a. While the specification discloses that plural LEDs that emit various colors may be used in conjunction with fluorescent layers that emit a different color from the plural LEDs, the specification does not disclose fluorescent converters being employed in conjunction with a set of plural semiconductor LEDs that includes an LED emitting the same color as that of the fluorescent material.

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[1]Much of the present Office action is copied from the previous action (paper #19). The primary issues raised by the present amendment are addressed in boldface type for clarity, but other portions of the present Office action also includes a few changes from the previous Office Action which the Examiner subjectively believes to be minor.

b. These claims--setting forth a plurality of LED units, wherein each unit comprises two LEDs--effectively require that each device include at least four LEDs. The Examiner cannot find support for this potential interpretation of the claims.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-3, 5-10, 21, 26-34, 38, 40 and 41 are rejected under 35 U.S.C. 103(a) as obvious over Soules '254 in view of Butterworth '507, Tsutsui '536 **and Nakamura et al. '558.**

a. Soules discloses LEDs or laser diodes that emit primary, blue light in the range of 420-470 nm (col. 3, lines 57-60). The LED is covered with a phosphor-containing polymer layer 15 and clear polymer lens 16 (e.g., FIG. 2), and both of these materials may be composed of the same material such as silicone (col. 3, lines 50-56). Various phosphors are employed so that a portion of the blue light emitted from the semiconductor device is absorbed and the phosphors emit secondary, green and red light respectively, so that the primary and secondary colors are blended to produce various colors including white light.

b. Regarding claims 8 and 32, since polymer layer 15 contains the phosphors and polymer layer 16 is composed of the same material as layer 15, but does not possess phosphors, the structure reads on a polymer layer having a step-graded phosphor profile.

c. Soules also discloses that the phosphor layer 15 is covered with a bullet-shaped sealing member 16 which are both composed of the same material, as set forth in various claims such as claims 5-7 and 9, but does not appear to mention the presence of conventional structures such as a lead frame having a cup-shaped portion. Also, while Soules sets forth that various fluorescent materials may be employed, it does not teach that any of the phosphors listed in claim 1 or 42 may be specifically employed.

d. Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame (or box, claim 42) and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54), as set forth in claims 1 and 42. Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65) and states that multiple dyes can be employed to produce white light (i.e., also use a red dye) (col. 3, line 5). Thus, it would have been obvious to one or ordinary skill in the art at the time of the invention to dispose the device taught by Soules on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward. It would have further been obvious to one of ordinary skill in the art at the time of the invention to have employed ZnS:Cu,Al,Au as taught by Butterworth as a fluorescent material for any of various reasons such as: (1) to obtain the particular hue associated with the specific

phosphor or (2) for business reasons such as relating to the cost and availability of a particular phosphor.

e. Claims 1 and 21 have been previously amended to set forth that the primary light source includes a GaN LED and includes a single reflective layer disposed on a surface of a substrate on which no light-emitter layer is formed (e.g., on the rear side of the substrate). Dependent claims 38-40 further set forth that the GaN emitter is formed on a sapphire substrate. Soules does not disclose the specific structural composition of the LED/LD that may be used nor the substrate on which the GaN emitter may be formed.

i. Tsutsui '536 discloses GaN emitters formed on sapphire substrates (e.g., col. 1) and teaches in the second embodiment (e.g., FIG 6) that the GaN chip may further possess a light reflection film 11 on the rear side of the sapphire substrate for reflecting light that is directed towards the substrate back towards the front, upper light emission surface (col. 7).

ii. It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the GaN emitter of Soules on a sapphire substrate because this is the most conventionally employed substrates for growing GaN structures, as evidenced by Tsutsui. It would have further been obvious to one of ordinary skill in the art at the time of the invention to have further included a substrate rear-side reflector layer in the Soules light emitter for the purpose of increasing light extraction from the front surface as taught by Tsutsui.

f. **The independent claims, such as claims 1 and 21, have now been amended to further set forth that a transparent electrode is disposed above the single reflective layer.**

Regardless of whether any of Soules, Butterworth and Tsutsui discloses this feature, Nakamura '558 does teach this limitation. Specifically, Nakamura teaches GaN-based LEDs formed on various substrates such as sapphire (e.g., col. 20, line 41) wherein a "light-transmitting electrode" (e.g., element 15) is formed above the p-side semiconductor layer(s)--and therefore above the reflective layer--for the purpose of improving ohmic contact and increasing the current spreading across the p-side layer (see e.g., Summary of Invention). Nakamura states that "light transmitting" means at least 1%--but usually 20 to 40%--of light emitted from the semiconductor emitter is transmitted therethrough, and does not necessarily mean colorless, transparent; col. 4, lines 57-64. Restated, the electrode may be either transparent, or partially transparent. Moreover, the present claims do not set forth any objective values for what percentage of light transmission constitutes "transparent." As such, layer 15 reads on the limitations regardless of whether the material specifically employed is fully transparent or partially transparent.

i. It would have been obvious to one of ordinary skill in the art at the time of the invention to have further employed within the emitters of Soules/Butterworth/Tsutsui a transparent p-side electrode for either of the purposes of increasing ohmic contact and improving the current spreading through the p-type semiconductor layer(s) as taught by Nakamura.

5. Claims 11-13, 15-20 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura '558 as applied to the claims above, and further in view of Hampden-Smith et al. '123. Soules discloses various phosphors that may be used for green and red photoluminescence, but does not appear to disclose any of the specific phosphors recited in the Markush group of claim 11 (ZnS:Eu and Y2O2S:Ce).

a. Hampden-Smith '123 teaches various sulfur-containing phosphors that can be used in an array of applications including photoluminescence (col. 35, lines 28-33). These phosphors include ZnS:Eu (paragraph spanning cols. 35-36); ZnS:Cu (Table 1, col. 37) and ZnS:Cu, Au, Al (col. 36, lines 8-15) for various hues of blue/green and CaS:Eu for red light (col. 36, line 19). It would have been obvious to one of ordinary skill in the art at the time of the invention to employ within the light emitter of Soules/Butterworth/Tsutsui/Nakamura, any of the phosphors specifically mentioned in Hampden-Smith for any of various reasons such as: (1) to obtain the particular hue associated with the specific phosphor or (2) for business reasons such as relating to the cost and availability of a particular phosphor.

6. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura as applied to the claims above, and further in view of Thompson et al. '489 (previously made of record).

a. The cited prior art teaches blue-emitting semiconductor LEDs overcoated with downconverter phosphors as explained above, but does not disclose the device used in combination with an additional red LED.

b. Thompson teaches a full-color LED assembly comprising two LEDs and a photoluminescent downconverter phosphor disposed for re-emission of longer wavelength light in response to light that is emitted from only one of the two LEDs. The phosphor may either emit green or red light. The LED that is not in communication with the downconverter phosphor may emit red light. Through the use of the combination of an LED with a phosphor and an LED without a phosphor, different colors of light can be selectively obtained subsequent to manufacturing.

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed a blue LED overcoated with a green-emitting phosphor as taught by Soules/Butterworth/Tsutsui/Nakamura as explained above in combination with a red LED instead of an additional red phosphor for the purpose of obtaining white light emission while simultaneously enabling increased post-manufacturing color control beyond that enabled by a blue LED overcoated with green and red phosphors at least for any of the purposes of (1) providing an assembly that can selectively emit various desired colors (e.g., red, blue and green, or white); (2) enabling later color readjustment in the event that the amount of blue or green light degrades or otherwise changes over time; or (3) providing an assembly wherein the red color is not subject to color alteration attributable to phosphor degradation. Further, it would have been obvious to use

a red-emitting LED for the LED which does not produce secondary phosphor re-emission, since Soules/Butterworth/Tsutsui teach the use of down-converting phosphors (i.e., phosphors wherein higher-energy, shorter wavelength colors are absorbed and re-emitted as lower-energy, longer wavelength colors), and red is the lowest energy, longest wavelength color of blue, green and red, thereby ensuring that regardless of the assembly's configuration or the two LEDs' relative disposition, any spurious light from this second LED will not cause any significant secondary re-emission in the phosphor.

7. Claims **43**-46, 49 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura as applied to the claims above **(and Hampden-Smith et al. '123 as applied to claim 44/11)**, and further in view of Komoto et al. '824 (previously made of record).

a. Komoto is directed towards GaN-based light emitters that emit preferably at wavelengths of 380 or shorter and which communicate with fluorescent materials for downconverting the primary light into various colors including white (e.g., col. 3, lines 22-). Komoto's lengthy disclosure and 141 figures include an array of information that is relevant to the present invention.

b. Regarding claims 43-45, the claim language of each of these claims, "...a plurality of LED units, wherein each unit comprises two LEDs from a group of a red LED, a green LED and a blue LED..." is interpreted as being broad enough to read on such a

device wherein both of the two LEDs emit the same color: e.g, both emit blue. Regardless of whether any of the base references further teach that the display device may include plural LEDs, note e.g., FIGs 115 and 116 of Komoto (and the associated discussion at cols. 52-53) wherein Komoto teaches that plural LEDs may be encapsulated within the same unit to increase luminance and to more uniformly spread light (col. 53, lines 22-25). It would have been obvious to one of ordinary skill in the art at the time of the invention to have provided plural LEDs in devices formed according to the base references for either of these two purposes taught by Komoto.

c. Regarding claim 46, regardless of whether any of the cited base references further teach that emitters may be arranged in a matrix and have a portion of said matrix being controlled by a controller, Komoto teaches that the devices may be used in a matrix for various types of displays (e.g., col. 2, lines 25-) including full color displays (e.g. col. 27, lines 1-). A full color display implicates the presence of a controller. It would have been obvious to have employed an emission system as taught by Soules/Butterworth/Tsutsui/Nakamura in a matrix with a controller for the purpose of enabling their use in a full color display as taught by Komoto.

d. Regarding claim 49, regardless of whether any of the cited base references further teach that the fluorescent material may be dispersed in a layer that is formed on top of a subjacent light transmittable layer that focuses the light, this is depicted at least in the embodiment of FIG 30C (fluorescent layer 440B is formed on layer 440). It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the fluorescent layer as an

overcoat, as well as in other manners (such as dispersed throughout as in FIG 30A) for the purpose of making the fluorescent layer's emission intensity more uniform as taught by Komoto.

e. Regarding claim 50, regardless of whether any of the cited base references further teach that the device may include two light transmission layers respectively including first and second materials, Komoto discloses variations of an embodiment in Figs 41-46 wherein a dipping layer (e.g., FIG 41, element 142E) includes a fluorescent material, and also discloses variations of an embodiment in FIGs 47-52 wherein a layer of fluorescent material FL is formed on top of the dipping resin layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined these embodiments so as to provide distinct fluorescent materials in each of the dipping layer and the fluorescent layer for the purpose of increasing the versatility of the manufacturing process be allowing the resultant color of a given batch to be changed to a wider array of colors by only changing or omitting the particular fluorescent material of one of the layers.

Response to Arguments

8. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Steigerwald et al. '218 discusses the use of transparent and semitransparent p-side electrodes at e.g., col. 1, lines 39-65.

INFORMATION ON HOW TO CONTACT THE USPTO

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister,** at **(703) 306-9165.** The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Tom Thomas, can be reached at (703) 308-2772. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

BRADLEY BAUMEISTER
PRIMARY EXAMINER

B. William Baumeister

Primary Examiner, Art Unit 2815

December 5, 2003